



Public Policies and Equality of Opportunity for Wellbeing in Multiple Dimensions: A Theoretical Discussion and Evidence from Bolivia

Jaya Krishnakumar¹ · Ricardo Nogales^{2,3}

Accepted: 9 December 2019 / Published online: 18 December 2019
© The Author(s) 2019

Abstract

Roemer's equality of opportunity (EOP) theory is increasingly used as the framework for assessing the link between public policies and social justice. Most studies focus on a single (monetary) wellbeing indicator and take individual efforts as being randomly distributed. However, recent development theories have uniformly advocated the use of a multidimensional wellbeing measure and the importance of individual responsibility. We propose a theoretical framework and a modelling tool to include these aspects in an assessment of the connection between public policies and inequality of opportunity for wellbeing within a Romerian setting. Using Bolivian data, we demonstrate the empirical usefulness of our framework and find that Bolivian social programmes are strongly associated with the reduction of unfair inequalities arising from ethnicity and family background, although their levels are far away from being optimal. We highlight the role of effort in this connection and show that it is a fundamental mediating factor.

Keywords Wellbeing · Equality of opportunity · Public policy · Simultaneous equation models · Latent variables

1 Introduction

Literature on the effect of public policies on people's wellbeing is fast growing and recent years have seen numerous empirical endeavours to measure their associations with inequality of opportunity as well (Bourguignon et al. 2007; Ferreira et al. 2011; Ferreira and Gignoux 2013, 2008; Figueiredo and Ziegelmann 2010; Betts and Roemer 2005; Coco and Pignataro 2010; Jacquet and van de Gaer 2011; Roemer et al. 2003). From the academic

✉ Ricardo Nogales
ricardo.nogales@qeh.ox.ac.uk; rnogales@upb.edu

Jaya Krishnakumar
jaya.krishnakumar@unige.ch

¹ University of Geneva, Geneva, Switzerland

² University of Oxford, Oxford, UK

³ Universidad Privada Boliviana, Cochabamba, Bolivia

and policymaking viewpoints, the need to better understand this linkage is evident and yet the task is highly complex for several reasons.

Policymakers need a clear statement of a normative rule guiding their interventions for moving towards a state of the world that should be promoted in terms of equality. Aiming for equality of outcomes may sound appealing at first sight, but a deeper analysis would bring out its insensitivity to the freedom or choice aspect of wellbeing (Arneson 1989). Similarly, equality of resources is also not advisable because it does not take into account individual heterogeneity in the ability to convert the resources into wellbeing (Schokkaert 2007). A third alternative, namely equality of opportunity (EOp) (Roemer 1998) has been gaining ground in recent years by virtue of its focus on giving an equal chance to everyone to achieve valued outcomes by the elimination of influences of conditions or situations beyond an individual's control. In the EOp framework, a fair society is defined on the basis of this *levelling the playing field* idea, condemning outcome disparities that are caused by differences in e.g. gender, ethnic condition or family background. On the other hand, the EOp stresses that differences in observable outcomes caused by differences in individual effort or willingly taken decisions may not be considered as unfair. Thus this approach provides a clear basis for considering certain types of public policies to be optimal from an EOp point of view.

In this paper, we make a justified case that the fast-growing number of applications of the EOp principle may benefit from a general methodological framework that allows for an empirical assessment of the connection between public policies and individual wellbeing, considering the latter as a multidimensional concept. First, most of the studies so far leave people's actions or efforts in the error terms (see e.g. Pignataro 2012), while in our view, their role in the connection between circumstances and public policies deserves a more explicit empirical consideration. Another important issue is the scope of definition of wellbeing. There is now a large consensus in the academic literature that the concept of wellbeing transcends material and monetary considerations (e.g. Atkinson 2003; Sen 1980, 1985, 1999; Alkire and Foster 2011) and cannot only be based on a one-dimensional approach (Atkinson 2019). Even at the policy level, several widely accepted international initiatives such as UNDP's Human Development Index (Haq 1999; Sen 1999), or Multidimensional Poverty Index (Alkire and Foster 2011), OECD's Better Life Index (<http://www.oecdbetterlifeindex.org/>), and the UN's Sustainable Development Goals (<https://sustainabledevelopment.un.org/>) advocate a multidimensional conception of wellbeing.

Our study incorporates the theoretical idea of the above considerations in an EOp analysis to provide an analytical tool as well as a practical solution to the problem of effective policymaking for wellbeing with justice. Following this idea initially put forward in the paper by Krishnakumar and Nogales (2015), we develop a general theoretical framework for assessing the connection between public policies and inequality of wellbeing opportunity. Our framework will enable one to not only answer questions regarding what type of circumstances need to be addressed in priority by policymakers for achieving equality of opportunity, but also pinpoint to the specific dimensions of wellbeing for which public action seem to have a strong opportunity equalising effect.

We do acknowledge that the unavailability of adequate data may play a limiting role in the successful implementation of the comprehensive framework that we describe in this paper. This is the reason why we go beyond the conceptual formalization to develop an econometric model that allows for the possible unobservable (latent) nature of certain concepts that can be estimated using existing datasets with limited information. We thus demonstrate that our theoretical framework can be successfully applied in an empirical context, making use of information that is readily available in most countries.

Using Bolivian data, we provide compelling evidence for (1) a practical implementation of our framework with publicly available data coming from a standard household survey, (2) the relevance of adopting our proposed framework over more traditional EOp implementations, which are in fact, special cases of the former, and (3) the usefulness of the results that our framework can deliver for policy purposes.

The paper is structured as follows: in Sect. 2 we argue for a more comprehensive theoretical framework for describing the relationship between public policies and individual wellbeing. In Sect. 3 we develop an econometric model for validating the theoretical relations established in the previous section. Sect. 4 presents an empirical application using Bolivian data and discusses the results as well as the evidence they provide for our theoretical and methodological claims. Finally, Sect. 5 summarizes our main findings and presents some concluding remarks.

2 The Theoretical Framework

We start this section by briefly discussing Roemer's EOp rationale and then supplement it with some key features from one of the most influential human development paradigms today namely, Sen's Capability Approach (CA, Sen 1980, 2009), in order to arrive at a more comprehensive framework for analysing EOp.

2.1 A Brief Analytical Overview of Roemer's EOp Rationale

There are an increasing number of studies that build upon Roemer's EOp theory to analyse inequalities in different outcomes (Betts and Roemer 2005; Bourguignon et al. 2007; Jacquet and van de Gaer 2011; Krishnakumar and Wendelspeiss 2011; Ramos and van de Gaer 2012; Roemer 1998; Roemer et al. 2003; Pignataro 2012; Wendelspeiss 2015). According to this approach, it is key to distinguish between fair and unfair inequalities of opportunity to achieve any lifestyle outcome. EOp recognises two main sets of determinants; the first are called circumstances and are beyond an individual's control such as race, native language or family background. The second are called efforts and can be influenced, to some extent, by each individual, such as her level of education, occupation or migration dynamics. In this framework, public policies play a crucial role in determining outcome indicators because they can be used as instruments for leveling the playing field. One can formalize Roemer's idea as follows:

$$y = f(C, F, pol, x, u) \quad (1)$$

where y is one observable indicator of lifestyle outcome, C is a vector of circumstances, F is a vector of efforts, pol is a vector of policy variables, x a vector of controls and u represents all unknown determinants of y . To the best of our knowledge, Bourguignon et al. (2007) were the first to complement the above formalization by allowing for efforts to be partially influenced by circumstances, in their study analyzing inequalities of earnings in Brazil. This leads to:

$$y = f(C, F(C, v), pol, x, u) \quad (2)$$

with v representing the component of efforts that is independent of circumstances and assumed to be random. The latter equation is in fact a reduced form that relates

circumstances to outcome indicators, letting efforts to be merged with the other residual explanatory factors of these indicators:

$$y = g(C, pol, x, e) \quad (3)$$

where $e = g_e(u, v)$.

Based on this formulation, most of the current body of empirical literature operationalizing EOp tends to focus on the *compensation approach* and assess inequality of opportunity by analyzing the extent to which differences in observable outcomes originate from differences in circumstances. In other words, equality of opportunity for achieving y requires that $\frac{\partial f(\cdot)}{\partial C} = 0$ and $\frac{\partial g(\cdot)}{\partial C} = 0$. The extent to which this condition is violated can be considered as an indicator of unfair (ex-post) inequality of opportunity because it means that individuals' outcomes are affected by characteristics that they cannot or could not control. According to this framework, the optimal (i.e. ex-post equal opportunity) public policy is one that contributes to equalization of outcomes for individuals who have exerted the *same* level of effort, irrespective of their circumstances. Practically speaking, it amounts to focusing on the least advantaged, i.e. people experiencing the lowest levels of outcomes, and removing the circumstance-related barriers they face as a rule for social justice (Roemer 1998).

These ideas have been applied to create sound measures of inequality of opportunity for income (Bourguignon et al. 2007; Ferreira and Gignoux 2008; Figueiredo and Ziegelmann 2010), access to credit markets (Coco and Pignataro 2010), living conditions (Ferreira et al. 2011), educational levels (Asadullah and Yalonzky 2012; Ferreira and Gignoux 2013) and health (Jusot et al. 2013; Van de Gaer et al. 2013) amongst others. These measures rely on an empirical estimation of (3), with efforts combined with residual stochastic elements, and construction of counterfactuals for y in conditions of equality of certain specific circumstances for all. These applications have been elegantly refined to identify direct and indirect effects of circumstances over observable outcomes (Bourguignon et al. 2007) and correct for omitted variable bias (Wendelspeiss 2015).

2.2 Our Contribution

In this section, we would like to make the case that the operationalisation of the EOp framework, as done in the above-mentioned studies can greatly benefit from some theoretical extensions in the formulation of the relationship between public policies and individual wellbeing, that align it better with recent developments in the field of wellbeing and human development. These extensions are inspired from the CA (Sen 1980, 2009), in particular its emphasis on individual choices as well as its broad definition of wellbeing.

First is the explicit account of individual efforts, even if they are intrinsically unobservable Freedom of choice is a prominent feature of the CA as it clearly distinguishes between advantages (*potential* wellbeing) and *actual* observed outcomes, and emphasizes the role played by individual factors in the process of conversion of advantage into actual wellbeing. Thus people's ability to set their own goals and strive to achieve them is key to understanding wellbeing according to the CA. This idea is partially represented in the EOp framework by the concept of *effort*, as it accounts for willingly taken actions that have an impact on individual wellbeing. However, efforts are regularly merged with residual error terms in empirical applications of the EOp (see e.g. Bourguignon et al. 2007; Cogneau and Gignoux 2008; Ferreira et al. 2011; Hederos et al. 2017). No doubt, efforts are hard to directly observe, but recent studies have started searching for appropriate ways to include explicit (even if partial) measures of effort in inequality of opportunity assessments (see e.g. Mahler and Ramos

2017). In our view, efforts play such an important role in the determination of wellbeing that they deserve to be more visible than simply being amalgamated with the stochastic error terms. Here we make an attempt to explicitly account for them in the model, accepting that they are intrinsically unobservable, and can therefore be only partially gauged through a set of observed indicators.

Second is taking a multidimensional approach to wellbeing One-dimensional approaches to human development and wellbeing are now commonly perceived as limited frameworks (Atkinson 2003, 2019). The CA's pluralistic view of human life is a fundamental concept that is hardly explicit in the EOp framework. A multidimensional assessment of inequality of opportunity is still rather scarce in the literature, some notable exceptions being Yalonetzky (2012) and Islam and Mitra (2017). According to the CA, multiple dimensions, including material and non-material aspects of life, are needed for a full description of personal wellbeing. Furthermore, these multiple dimensions of human life mutually influence one another (health, education and work advantage may be one of the most intuitive examples) and this needs to be explicitly taken into account in any attempt to study wellbeing and its determinants. Formally, this means that the evaluative space of wellbeing needs to be expanded to simultaneously include multiple dimensions of people's lives as well as their interdependencies, and that failing to do so would amount to relying on a thin informational basis. Almost all EOp studies have only considered a single outcome, although the outcome studied may be a non-monetary one such as health in a few of the works. To the best of our knowledge, there has been no study so far that simultaneously examines multiple interdependent outcomes.

Third is going beyond actual outcomes to focus on potential lifestyle as the evaluative space Throughout his work, Sen advocates the expansion of freedom to choose the lifestyle that one has reason to value, as a partial guide to the moral good of wellbeing enhancement. This freedom to choose or *advantage* is the preferred evaluative space for wellbeing, and is defined as the set of *potential* lifestyle outcomes of a person, given her resources and circumstances, from which she can make a choice. This set of *potential* wellbeing states (the *capability* set) is given the normative priority over the actual observed lifestyle outcomes themselves (Gaspar 2007; Schokkaert 2007). Taking this idea to the EOp framework, one would want to focus on *potential* wellbeing as the outcome of interest, along the lines of Pignataro (2012), Ramos and van de Gaer (2012) and Van de Gaer et al. (2013) which make a case for using *expected* or *possible* lifestyle outcomes for assessing inequality of opportunity, rather than observed outcome indicators. In our paper, we take this route and go further to postulate that the concept of *expected* or *potential* wellbeing is unobservable (latent) by definition but manifests itself through multiple observed indicators. The usefulness of such a methodology for operationalising the CA and analysing human wellbeing is discussed in Krishnakumar and Nogales (2018) and empirically demonstrated in Di Tommaso (2007) and Krishnakumar (2007) for instance.

We include all the above three extensions in our theoretical structure to analyze the EOp property of a policy. In other words, we will examine EOp in multiple and interdependent dimensions of wellbeing that are simultaneously influenced by circumstances as well as efforts, with possible unobservability of certain concepts.

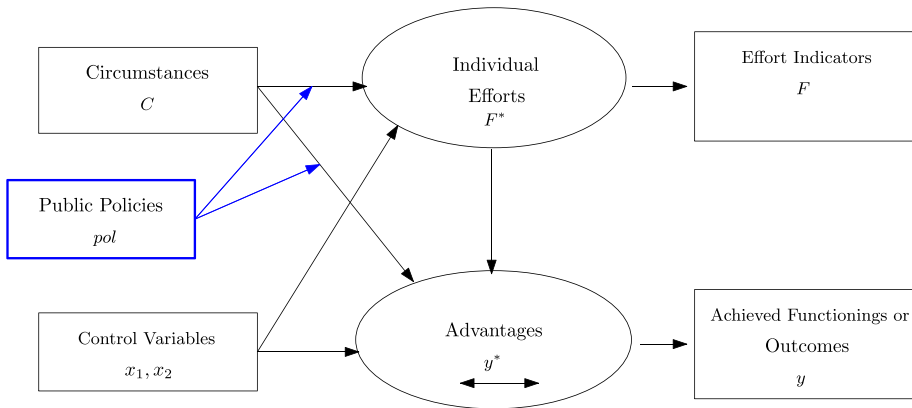


Fig. 1 The theoretical structure

3 The Model

3.1 The Theoretical Structure

Let us now introduce the above-mentioned theoretical developments in the formulation of our model. Following the CA, our concept of wellbeing consists of i) achieved/observed outcomes in multiple dimensions denoted as y , in turn associated with a ii) set of *potential* lifestyle outcomes termed as *advantage* (y^*). We assume that the latter is unobservable (i.e. latent) due to its counterfactual nature. Further, we explicitly introduce effort variables (F^*) in our wellbeing equations even while acknowledging that they are also hard to directly observe. Hence we also assume them to be latent taking some observed indicators (F) as partial measures. Thus, our theoretical structure can be described by the following diagram (Fig. 1).

Advantage and efforts are directly associated with individual and social circumstances denoted jointly as C . In keeping with the spirit of the CA, the role of public policy (pol) is to expand advantage for all and thus, from an EOp angle, it is associated to the attenuation or even the elimination of the effect of circumstances on advantages and efforts. Naturally, the evident intertwining of different wellbeing dimensions is also taken into account.

The depicted theoretical structure can be formalised by the following system of four vector equations:

$$\begin{cases}
 y^* = f_{y^*}(y^*, C, F^*, pol, x_1, e_1) & (4a) \\
 F^* = f_{F^*}(C, pol, x_2, e_2) & (4b) \\
 y = f_y(y^*, e_3) & (4c) \\
 F = f_F(F^*, e_4) & (4d)
 \end{cases} \tag{4}$$

Our key relationship for studying inequality of opportunity is vector equation (4a) which states that individual advantage in multiple dimensions, denoted as vector y^* , is influenced by circumstances (C), efforts (F^*) and public policies (pol). Note that the focus in this equation is on advantage, i.e. *expected* lifestyle outcomes and not on *actual* outcomes. We take into account the interdependence of advantages in multiple dimensions, which is why we allow y^* to appear in both sides of the set of equations. x_1 represents exogenous (control) variables and e_1 denotes the vector of error terms in these relationships.

The second equation (4b) accounts for the fact that efforts F^* are potentially influenced by circumstances, C , and public policies, pol , as postulated by EOp. The vector of error terms in these relationships is denoted by e_2 , and x_2 represents exogenous control variables.

The third vector equation in the system (4c) links multiple achieved lifestyle outcomes in various dimensions, y , to a person's advantage in these dimensions, y^* , reflecting the choice process that we discussed earlier. In other words, the observed outcome indicators are considered as partial manifestations of a person's advantage. The error vector of these relationships is denoted as e_3 .

The last vector equation (4d) is similar to the third one in that it assumes effort F^* to be latent and partially measured by certain indicators collected in F . e_4 is the error vector of these equations.

From a statistical and econometric point of view, equations (4a) and (4b) are called structural equations, and (4c), (4d) measurement equations. Let us now explain the need for treating this system of equations as a *Simultaneous Equation Model*, (SEM) and the impossibility of treating each equation separately. First, it is evident that equations (4a) and (4c) cannot be separated, as the latter is the measurement equation corresponding to the former. The same statement holds for equations (4b) and (4d). Second, we wish to avoid taking the simplistic route of assuming that the structural equations (4a) and (4b) are independent from each other. We posit that unobservable effort determinants, e_2 , very likely include expected individual advantage, as efforts are rational individual choices. Thus any attempt to estimate these equations separately will produce biased results.

Before going on with the specification of the different functions, we point out that many models often encountered in the literature are in fact some special cases of our general setting.

3.2 Traditional Models as Special Cases of the General Structure

The system that we describe in (4) is a general setting, which can be used for a comprehensive study of EOp in a wide array of empirical contexts. Let us note that the vast majority of existing studies (see e.g. Pignataro (2012) for a review on this matter) rely on a simpler version of our theoretical proposal (given in (3)), which is only a special case of (4). In fact, several simpler (reduced) frameworks can be deduced from this system, in particular the ones that do not consider the three analytical elements that we have introduced in our framework.

If explicit effort measures are omitted from the analysis, then equations (4b) and (4d) are simply dropped from in (4) and the effort variable, F^* , is merged with the error terms in equation (4a). In this case, system (4) reduces to:

$$\begin{cases} y^* = f_{y^*}(y^*, C, pol, x_1, \tilde{e}_2) \\ y = f_y(y^*, e_1) \end{cases} \quad (5)$$

where $\tilde{e}_2 \equiv e_2(F, e_2)$ and possible correlation between C and \tilde{e}_2 .

If, in addition, focus is only on one specific dimension of wellbeing but with multiple features, then the first equation in system (5) will have a scalar y^* on the left-hand side (which will be absent from the right hand side). Then the system (5) is further simplified to:

$$\begin{cases} y^* = \tilde{f}_{y^*}(C, pol, x_1, \tilde{e}_2) \\ y = f_y(y^*, x_1, \tilde{e}_1) \end{cases} \tag{6}$$

where the first part becomes a single equation and the second part a vector of measurement equations. Note that possible correlation between C and \tilde{e}_2 remains.

Finally, in a framework directly focusing on a single *observable* lifestyle indicator y as the measure of wellbeing, a further simplification of system (6) is possible. In this case, there is no need for the measurement equations and one obtains a simpler reduced form:

$$y = \tilde{f}_y(C, pol, x_1, e_3) \tag{7}$$

where e_3 is an error term incorporating efforts and random errors. Thus Eq. (7) [same as (3)] is one of simplest forms that our proposed analytical system of equations can take, which is what the majority of (ex-post) EOp studies is concerned with.

Next, let us go on to specify an econometric model that fits in with our general framework, that is, one which explicitly accounts for effort as a driver of wellbeing, adopts a multidimensional description of wellbeing and introduces the link between observed wellbeing outcomes and an underlying concept of advantage à la Sen [system (4)].

3.3 The Econometric Model

In this section we present the functional forms chosen for the specification and estimation of model (4). To begin with, let us recall that a Simultaneous Equation Model (SEM) *with latent variables* consists of two parts - a first set of equations describing the relationships between the variables of main interest (which are latent) and their determinants [(4a) and (4b) in our case], and a second set representing the outcome indicators as observed manifestations of the latent variables [(4c) and (4d)] (Skrondal and Rabe-Hesketh 2004; Muthén 1983, 1984, 1988, 2002). Let us now look at the specification of the two parts in more detail.

3.3.1 The Structural Equations

For a more compact notation, let us collapse our latent elements, namely advantage and effort, into a single vector $\theta^* \equiv (y^*, F^*)'$ and their corresponding observed manifestations into a vector $\theta \equiv (y, F)'$. Further, let us denote by vector $x \equiv (x_1, x_2)'$ the set of relevant control variables. Thus, the first and second vector equations in (4) may be represented by a single vector equation as follows:

$$g(\theta^*, C, pol, x, \xi) = 0 \tag{8}$$

where $\xi \equiv \xi(e_1, e_2)$.

In our framework, public policies (pol) act on the effect of C on θ^* . Assuming a linear form for $g(\cdot)$, we can therefore write:

$$A\theta^* - T(pol)C - Bx - \xi = 0 \tag{9}$$

where A is the coefficient matrix that describes the interdependencies among the elements of the vector of advantages and efforts. Matrix T contains the relationship coefficients of circumstances with each of the endogenous latent variables in the model, susceptible to be modified by policy variables, and hence is a function of pol . Matrix B captures the effect

of control variables included in x . The vector of errors ξ is assumed to have zero mean and a full variance-covariance matrix Σ that is individually invariant. In theory, one has to impose some constraints on the elements of coefficient matrices A , B and C for our structural model to be identified. We will discuss our identification restrictions when we present our empirical model.

Taking a general linear form for $T(pol)$, then we can write:

$$T = T(pol) = \Gamma + \Pi pol \quad (10)$$

In this relation, Γ is a matrix of constant elements, Π is the matrix measuring the force of influence of public policies on the relationship coefficients. Substituting (10) into (9) yields:

$$A\theta^* - (\Gamma + \Pi pol)C - Bx - \xi = A\theta^* - \Gamma C - \Pi z - Bx - \xi = 0 \quad (11)$$

where $z \equiv pol \times C$ represents the interactions of public policies and policy-sensitive circumstances.¹ These interactions capture the extent to which the policy instrument affects the way in which each of the circumstances is associated with advantages as well as efforts.

Comparing Eqs. (9) and (11), matrix T has been divided into matrices Γ and Π , where the first captures the direct effect of circumstances and the latter captures the indirect effect of public policies through their interaction with policy-sensitive circumstances.

3.3.2 The Measurement Equations

With the above notations, equations (4c) and (4d) in system (4) may be regrouped into a single vector equation that describes the link between the latent and observed variables in our framework:

$$\theta = h(\theta^*) + \epsilon \quad (12)$$

The error terms are also combined in a vector $\epsilon \equiv (e_1, e_2)'$ that is assumed to have zero mean and a full variance-covariance matrix denoted as Ω . Vector ϵ is assumed to be uncorrelated with the errors ξ of the structural equations.

The functional form of $h(\cdot)$ depends on the type of indicator that is observed. In general, we can have two types of indicators of advantages and efforts: continuous, such as income, or discrete, such as the educational level (categorical) and speaking a language other than native (dichotomous). When the indicators are continuous, the measurement relations are linear; otherwise, they take a nonlinear form.

3.4 Assessment of Multidimensional Inequality of Opportunity

In our setting, perfect EOp is associated with $\frac{\partial y^*}{\partial C} = 0$, that is, when circumstances that are beyond an individual's control do not affect, either directly or indirectly (through efforts), the set of possible lifestyle outcomes of an individual. Note that we need to estimate our structural model in its full form, i.e. system (4) as re-specified in (11) and (12), as all its coefficients are needed to derive and distinguish between the direct and indirect effects of circumstances, as well as to derive the EOp-compatible (optimal) level of public policies.

¹ Matrix Π contains null-valued elements whenever a circumstance is not policy-sensitive.

Using estimates of these structural coefficients, we can derive the reduced form of (11)—i.e. solution for θ^* —as follows:

$$\theta^* = A^{-1}\Gamma C + A^{-1}\Pi(pol \times C) + A^{-1}Bx + A^{-1}\xi \tag{13}$$

This reduced form will in turn enable us to calculate the total effect of policy on the link between circumstance and wellbeing. Let us consider a specific element of θ^* that is related, for instance, to a specific advantage h , say θ_h^* . Also consider a specific policy instrument, pol_k and a circumstance that is sensitive to this policy say C_j and is a determinant of θ_h^* . Then the total effect of C_j on θ_h^* is given by:

$$\frac{\partial \theta_h^*}{\partial C_j} = d_{h,j} + \sum_{k=1}^q \phi_{h,j}^k pol_k \tag{14}$$

where $d_{h,j}$ is the element of matrix $D \equiv A^{-1}\Gamma$, associated with C_j , and represents the direct effect of this circumstance on θ_h^* . Coefficients $\phi_{h,j}^k$ represent the elements of matrix $\Phi \equiv A^{-1}\Pi$, that are associated with the interaction term between C_j and the k -th policy instrument pol_k .²

The value taken by pol_k would represent an optimal configuration of the k -th public policy if it is such that $\frac{\partial \theta_h^*}{\partial C_j} = 0$, implying that the total effect of circumstance C_j over θ_h^* is null.

Let us denote as $pol_r^*(C_j)$ the optimal configuration of the r -th policy instrument for the i -th individual relative to the j -th circumstance for the h -th advantage. Building from Eq. (14), one can derive:

$$pol_r^*(C_j) = -\frac{d_{h,j}}{\phi_{h,j}^r} - \sum_{k=1, k \neq r}^q \frac{\phi_{h,j}^k}{\phi_{h,j}^r} pol_k \tag{15}$$

Since this optimal configuration of the policy instrument nullifies the effect of circumstance over an advantage, it is compatible with a maximization of the latter. Thus we see that estimates of structural parameters are required to derive the the EOP-compatible levels of policy variables.

One can note from (15) that if there are more than one policy variables, then the optimal value of any single policy variable depends on the other policies.³

In general one could have three possible policy effects (assuming that $pol_k > 0$):

- The policy attenuates unfair inequality of opportunities if $d_{h,j}$ and $\phi_{h,j}^k$ have opposite signs.

² Note, however, that even if the coefficients are individually invariant, the total effect of C_j on θ_h^* has an inter-group variance, where a group is formed by the individuals for which pol_k takes the same value. For example, if we consider municipal public expenditure on education as a policy instrument of interest, the individuals that live in the same municipality would form a group.

³ In the general setting that we present here, we can derive a set of optimal values for each policy variables in a $q - 1$ dimensional hyperplane. In the case of two policy variables ($q = 2$), we can derive a set of optimal values for each one of them as a function of the other. If we have only one policy variable, then its optimal value becomes: $pol_r^*(C_j) = -\frac{d_{h,j}}{\phi_{h,j}^r}$. We are well aware of the richness of our proposed framework and will go on to derive its precise theoretical as well as empirical properties in subsequent research.

- The policy exacerbates unfair inequality of opportunities if $d_{h,j}$ and $\phi_{h,j}^k$ have the same sign, or $d_{h,j} = 0$ while $\phi_{h,j}^k \neq 0$.
- The policy has no effect over unfair inequality of opportunities if $\phi_{h,j}^k = 0$ regardless of the sign of $d_{h,j}$.

4 Empirical Illustration Using Bolivian Data

Our empirical illustration concerns Bolivia for which we wish to assess the connection between the policy instrument ‘social expenditures’ (including health and education) and equality of opportunity for wellbeing.

The assessment year was chosen as 2009 as it was the year in which a large nationally representative survey was conducted in Bolivia by UNDP, namely the Household Survey for Social Stratification and Mobility (HSSSM), which contains information at the individual level relevant for our analysis. The reason for choosing HSSSM is twofold. First, HSSSM contains information on characteristics of the household in which the individuals lived when they were 14 years of age, thus providing us with information about the respondent’s family background, which regularly receives careful attention in EOp empirical analyses. Second, the survey captures both objective and subjective information on different dimensions of wellbeing, enabling us to take a multidimensional approach for this concept that transcends purely monetary considerations. This dataset is combined with the official UDAPE⁴ municipal level public records for our analysis. Public expenditure data at the municipal level were collected for the period 1999–2003 and it is the only period for which they are available at this level. The years for which data are available for the 327 Bolivian municipalities enabled us to give sufficient time between the time of expenditures (1999–2003) and that of wellbeing measurement (2009) for evaluating the connection between policy variables and individual wellbeing. We are aware that these municipal expenditures continued beyond 2003, which might have also influenced the situation in 2009. However, the idea here being that policy actions take time to have a concrete effect on the ground, we assume that the later expenditures would have produced most of their effect after 2009. Our estimates have to be interpreted keeping this in mind.

Based on data availability, we are able to investigate two dimensions of wellbeing: (1) *material conditions advantage*, which captures monetary and tangible aspects of individual wellbeing and (2) *life satisfaction advantage* that complements the first dimension with self-assessed wellbeing, reflecting the capability to be satisfied with life.

Material conditions advantage is measured by four variables: (1) a residency equipment index computed as the simple mean of three dichotomous variables indicating whether the respondent has access to a fixed phone line, a mobile phone, and access to internet; (2) a residence quality index calculated as the simple mean of three dichotomous variables indicating whether the respondent lives in dwelling with adequate roof, floor and walls,⁵ (3) a basic living conditions index computed as the simple mean of four dichotomous variables

⁴ Bolivian government’s Unit for Economic Policy Analysis: <http://www.udape.gob.bo>.

⁵ Based on the DHS 2008 survey standards for the country, inadequate floor is taken to be made of mud/clay/earth, sand or dung; inadequate roof or walls are constructed using natural materials such as cane, palm/trunks, sod/mud, dirt, grass/reeds, thatch, bamboo, sticks, or rudimentary materials such as carton, plastic/polythene sheeting, bamboo with mud/stone with mud, loosely packed stones, uncovered adobe, raw/reused wood, plywood, cardboard, unburnt brick or canvas/tent.

indicating whether the respondent has access to safe drinking water,⁶ adequate sanitation facilities,⁷ electric power, and adequate cooking fuel;⁸ and (4) crowding (number of bed-rooms per household member).

Life satisfaction advantage is, in turn, measured by self-assessed fulfillment with the three most important aspects in people's lives. In these data, people are free to state what is important for them to 'live well' and then to indicate the level of fulfillment with each statement in a scale of 1 (Very Bad) to 10 (Excellent). To have an idea of what is being measured, it is worth noticing that the most frequent answer is to 'be healthy and having stable jobs' (38% in first place, 28% in second and 20% in third). This shows that we are in fact capturing long-lasting aspects of human life, and not transitory or unstable self-assessments.

As a preliminary investigation of the possible lagged effect between our policy variable and the wellbeing indicators, we look at the correlation coefficients between the two (sets of) variables that are observed at different points in time as mentioned above. The correlations (see Table 1) are significant with the expected signs, thus indicating possible influences over time of our policy variable on wellbeing, along the same lines as, for instance, Hidalgo-Hidalgo and Iturbe-Ormaetxe (2018) (on linkages with material conditions) and Layard (2006); Forgeard et al. (2011) (on linkages with subjective wellbeing).

Descriptive statistics of the variables included in our model are presented in Table 2, which were chosen in order to make the most out of the available information. Since we wish to include explicit indicators of individual effort in our model, we focus on a specific sub-population of individuals who fulfill the following conditions: (1) they are at least 18 years old, because they are mature enough to be legally responsible for their actions (2) they are either household heads or their spouses, so they can be held responsible for some household characteristics. This leaves us with a sample of 3782 individuals.

We seek to analyze how these dimensions of wellbeing and their links to *two circumstances*, namely *ethnicity* and *family background*, are affected by our policy variables. Ethnicity is measured as a dichotomous variable taking the unity value if the respondent's first language during childhood was an indigenous one (Quechua, Aymara, Guaraní or other minority indigenous language). It takes the value of 0 if the respondent's first language during childhood was Spanish. Family background is measured by the years of schooling of the head of the household when the respondent was 14 years. We focus on these two circumstances because we want to revisit the extensive academic literature about ethnic discrimination and disadvantages faced by indigenous population in Bolivia [see e.g. Horn (2017) for a recent discussion on this matter], as well the limited mechanisms for social mobility in the country (see e.g. Neidhofer et al. 2018). This parsimonious set of circumstances will allow us to present a detailed, useful discussion about the usefulness of our framework for policy purposes.

We wish to transcend correlational descriptions and investigate the role of individual effort in this connection. Since effort is related to willingly taken decisions and actions, we consider that it may be partially captured through three indicators that are available in

⁶ Following the MDG standards, we consider drinking water as safe if the water source is any of the following types: piped water, public tap, borehole or pump, protected well, protected spring or rainwater.

⁷ Following MDG standards, we consider sanitation facilities to be adequate if they have some type of flush toilet or latrine, or ventilated improved pit or composting toilet, provided that they are not shared.

⁸ We consider cooking fuel to be inadequate if it is dung, wood or charcoal, which are associated to respiratory diseases.

Table 1 Correlation coefficients between the mean annual per capita public expenditure in 1999–2003 and the average level of each observed wellbeing indicator at the municipal level

Observed indicator	Material conditions dimension			Life satisfaction dimension		
Basic living conditions	Residence quality	Residency equipment	Crowding	Most important aspect	Second most important aspect	Third most important aspect
0.254***	0.177**	0.225***	-0.192**	0.166**	0.244***	0.250***

*** $p < 0.001$; ** $p < 0.05$; * $p < 0.1$

Table 2 Descriptive statistics

Variable	Mean (modal category)	SE	Min	Max
<i>Wellbeing dimension 1: material conditions advantage</i>				
Basic living conditions index	0.72	0.27	0	1
Residence quality index	0.70	0.33	0	1
Residency equipment index	0.42	0.35	0	1
Crowding	2.87 people/room	1.66	0.09	10
<i>Wellbeing dimension 2: life satisfaction advantage</i>				
Most important aspect	5.40	2.74	1	10
Second most important aspect	5.41	2.72	1	10
Third most important aspect	5.36	2.84	1	10
<i>Circumstances</i>				
Ethnicity (1 = indigenous)	0.32	0.47	0	1
Family background	5.50 years	5.7	0	17
<i>Policy variable</i>				
Public social expenditure	56.38 USD/person/year	36.26	0.34	166
<i>Effort indicators</i>				
Share of formal income	0.35	0.45	0	1
Occupation	Unsk. worker (28.29%)		Director	Unsk. worker
Years of schooling	7.49 years	5.28	0	17

our data. First is the share of income that is generated from formal working conditions. Formal positions offer due social security benefits, whereas informal positions are mostly related to self-employment and thus imply more risks for workers. Hence having a formal job implies a certain effort taken by the individual to acquire the necessary competencies to be competitive in the formal job market. Second is the occupation of the respondent, assuming that a higher professional status implies that an individual has worked hard to get there. The occupation variable is a 10-scaled ordered indicator going from a director post in the public private sectors (1) to unskilled manual workers (10). Third is years of schooling, depicting efforts exerted towards attaining higher levels of education and commitment towards knowledge acquisition. These effort indicators are quite similar to the ones used in Mahler and Ramos (2017)⁹ in an attempt to at least partially gauge this abstract concept. Although individual endeavour is present in all the above indicators, we are aware of the fact that surrounding circumstances also influence them and we do take this into account in our structural model.

Thus the diagram of our empirical model with the actual variables used can be represented as in Fig. 2 below.

⁹ The exact effort variables included in this study are years of education, weekly working-time, being self-employed and working in the public sector.

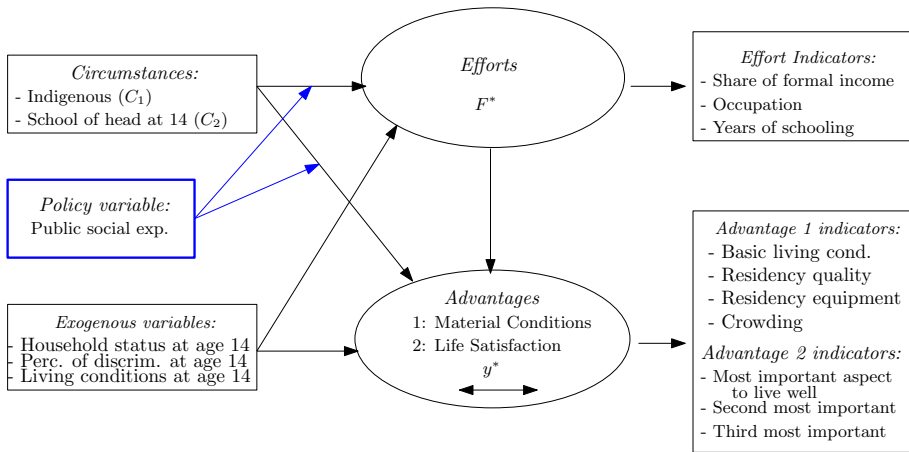


Fig. 2 The empirical model

4.1 Identification Assumptions in Our Structural Relations

Based on our theoretical framework and the available data, we make an attempt to postulate reasonable identification restrictions that allow us to estimate our structural coefficients. We are well aware of the considerable challenge of our endeavour, which is quite well acknowledged in the EOp empirical literature as it is common to all studies that use observational data (see e.g. Ferreira and Gignoux 2008). Nevertheless, we believe that it is possible in our context to posit credible inclusion/exclusion restrictions on our exogenous variables. Further, these identification assumptions, when duly justified, enrich the analysis by enabling us to separate the *direct* effects of circumstances on wellbeing from the *indirect* effects mediated by efforts. However, we also present the alternative scenario of having no exclusions in which case one can only estimate the *total* (direct + indirect) associations between circumstances and wellbeing. Note that even in the absence of exclusion restrictions, our model still manages to take into account all the three theoretical extensions proposed in Sect. 2.

To formally explain this, let us recall that the set of structural equations (11) has the following form: $A\theta^* - \Gamma C - \Pi z - Bx - \xi = 0$, where the endogenous vector θ^* has three elements: material conditions advantage (y_1^*), life satisfaction advantage (y_2^*) and efforts (F^*). Thus $\theta^* \equiv (y_1^*, y_2^*, F^*)'$.

We do not impose any constraints (zeroes) in our Γ and Π matrices, as we intend to gauge all the connections between circumstances and policy variables, as well as both advantages and efforts.

Matrix A is given the following configuration:

$$A = \begin{bmatrix} 1 & a_{2,2} & a_{1,3} \\ a_{2,1} & 1 & a_{2,3} \\ 0 & 0 & 1 \end{bmatrix}$$

where a_i are free parameters. Advantages are allowed to be influenced by each other and by efforts. We propose to exclude both advantages in the equation for efforts, justifying the

zeroes in two ways. First, from a theoretical perspective, Roemer's framework assumes that circumstances and efforts are exogenous in the wellbeing equation. In other words, wellbeing is the result of circumstances and efforts and not vice versa. Second, from an empirical point of view, effort indicators similar to the ones that we propose here have often been postulated as exogenous determinants of wellbeing in different practical contexts, such as health analysis (Jusot et al. 2013), and income and life satisfaction analyses (Mahler and Ramos 2017).

Finally, we make the following assumptions on the presence/absence of exogenous variables in the two wellbeing equations. These variables (x) are as follows: (1) housing conditions at age 14, captured by an index of basic and non-basic services ($x_{1,1}$), (2) a dummy variable indicating if the person has ever felt discriminated ($x_{1,2}$); and (3) perception of economic status of household at age 14, captured by a 10-scaled variable where 1=worst ($x_{2,1}$). Thus $x \equiv (x_{1,1}, x_{1,2}, x_{2,1})'$. We include housing conditions at age 14 as a possible direct determinant of current material conditions advantage as it may have led to inheritance and/or initial endowments from family. However, we exclude *perception* of discrimination and *perception* of economic status of household at age 14 from the equation of material conditions advantage, because these variables represent *subjective* conditions at a particular point in time in the past that may not have any long-lasting effect on current *material* aspects of wellbeing. We argue that any effect of these variables on the *current objective material* conditions may only come indirectly through their influence on people's *subsequent* actions and behaviour, i.e. efforts, which is accounted for in our setting.

Next, we include perception of discrimination as a direct determinant of life satisfaction advantage, as the question asks if they felt discriminated at *any* time and this feeling may have long lasting negative effects on self-esteem and perception of social acceptance/approval (Anand et al. 2010). We exclude housing conditions at age 14 and perception of economic status of household at age 14 as direct determinants of life satisfaction advantage, as the latter refers to the *current* satisfaction in life. Once again, we postulate that any effect of these variables on this advantage may come indirectly through personal actions and decisions, i.e. efforts.

Finally, we include all three exogenous variables as possible direct determinants of efforts as our effort variables also relate to the past.

Thus our configuration of matrix B is the following:

$$B = \begin{bmatrix} b_{1,1} & 0 & 0 \\ 0 & b_{2,2} & 0 \\ b_{3,1} & b_{3,2} & b_{3,3} \end{bmatrix}$$

where b are free parameters.

Imposing these restrictions leads to an exact identification of our model as it will then satisfy the necessary and sufficient rank conditions, since matrices of rank 2 can be formed by the coefficients of the excluded exogenous and endogenous variables in each equation.

In case one does not wish to make these exclusion restrictions, then it can be assumed that the matrix B is full i.e. all x 's influence all the endogenous variables. If one decides to take this route, only the reduced form of our model can be estimated i.e. only the *total* associations between circumstances and wellbeing. However, our model still incorporates all the proposed theoretical innovations. Thus it still remains an extension of traditional empirical EOp models, but one would not be able to separate the total effect into its direct and indirect (via efforts) components. We also implement this alternative in our estimations.

4.2 Estimation Results

Let us recall the theoretical extensions that we incorporate in our empirical model, namely (1) the explicit account of effort measures as drivers of wellbeing, (2) the multidimensional nature of wellbeing and (3) the need for going beyond observable lifestyle indicators to potential outcomes. In what follows, we examine four variants starting from a simple one without these extensions and adding them one by one in order to show their usefulness for a better understanding of individual wellbeing. Our discussion of results for all these variants will be based on standardized coefficient estimates which allow for meaningful comparisons among them, and they are presented in Table 3. For completeness, we also present the unstandardized coefficients in Appendix B.

The **first variant** is the simplest version of our model, which corresponds to equation (7) and depicts the traditional empirical application of the ex-post EOp framework. This variant does not account for any of our proposed analytical supplements: it includes effort in the error terms, it does not simultaneously account for multiple dimensions of wellbeing, and it treats the latter as fully observable and captured by one single outcome. Hence, we actually have as many versions of this variant as observable wellbeing indicators. For the sake of simplicity, we will limit ourselves to present only two estimation results. The first one includes the Basic Living Conditions Index as the dependent variable, which is one of our proxies for material conditions advantage (Model (1a)). In the second one, the dependent variable is the self-assessed satisfaction with the most important aspect to 'live well', which is one of the proxies for life satisfaction advantage (Model (1b)).

In the **second variant**, wellbeing is considered to be an intrinsically unobservable concept and it is treated as latent manifesting itself partially through observable indicators. This setting corresponds to system (5) and we are able to estimate two versions of this variant, each one taking one advantage as the dependent variable. Models (2a) and (2b) consider, respectively, material conditions advantage and life satisfaction advantage as the dependent variable.

In the **third variant**, the multidimensional nature of wellbeing is taken into consideration, and both advantages are *simultaneously* treated as unobservable (latent) dependent variables. This variant corresponds to the estimation of system (6), which we will denote as Model (3). As we have two dimensions of wellbeing treated simultaneously in this variant, Model (3) has two sets of parameter estimates, one for each advantage.

The **fourth variant** is the full version of our model, which corresponds to system (4) (Model (4)). It adds to the previous variants an explicit consideration of effort as a driver of wellbeing, treating it as an unobservable (latent) variable that can only be partially gauged through a set of observable indicators. As we have three dependent variables in this variant, namely two advantages and effort, Model (4) includes three sets of parameters.

The standardized structural parameters of the estimated model are presented in Table 3, so that they are comparable in magnitude. They only give the standardized *direct* effect of the considered variables on the latent ones because these effects do not incorporate relations among the latent variables.

In light of the estimation results, we find compelling evidence for the relevance of including every single one of the three theoretical extensions. We will discuss this evidence first, and then go on to a detailed discussion of the kind of results generated by the full variant (Model (4)).

Table 3 Estimation results (standardized coefficients)

	Model			
	(1a)	(1b)	(2a)	(2b)
Indigenous (C_1)	- 0.4512***	- 0.2408***	- 0.3911***	- 0.3635***
School of head at 14 (C_2)	0.3881***	0.1561***	0.1005***	0.2101***
Soc. expend. $\times C_1$	0.1786**	0.0605**	0.1683***	0.1344***
Soc. expend. $\times C_2$	0.0091	0.0035	0.0072***	- 0.0141
Controls	Yes	Yes	Yes	Yes
R^2	0.45	0.15	0.62	0.25

	Model				
	(3)		(4)		
	Dep. y_1^*	Dep. y_2^*	Dep. y_1^*	Dep. y_2^*	Dep. y_3^*
Indigenous (C_1)	- 0.3956***	- 0.1123***	- 0.3472***	- 0.2271***	- 0.1181**
School of head at 14 (C_2)	0.0825***	0.0862***	- 0.0207	0.1283**	0.2529***
Soc. expend. $\times C_1$	0.1986***	0.0287	0.1621***	0.0247	- 0.0122
Soc. expend. $\times C_2$	0.0842***	- 0.0688**	0.0580	- 0.1493***	0.0400
Mat. Cond. Adv. (y_1^*)		0.4127***		0.2489*	
Life Satisf. Adv. (y_2^*)	0.0491		0.0564		
Effort (y_3^*)			0.3412***	0.1362*	
Controls	Yes	Yes	Yes	Yes	Yes
R^2	0.64	0.35	0.70	0.39	0.54

*** $p < 0.001$; ** $p < 0.05$; * $p < 0.1$

The dependent variables are as follows:

Model (1a): Basic living conditions index (observed)

Model (1b): Satisfaction with the most important aspect to live well (observed)

Model (2a): Material conditions advantage (latent, noted y_1^*)

Model (2b): Life satisfaction advantage (latent, noted y_2^*)

Model (3): Two latent dependent variables are considered:

Material conditions advantage (y_1^*) and Life satisfaction advantage (y_2^*)

Model (4): Three latent dependent variables are considered:

Material conditions advantage (y_1^*), Life satisfaction advantage (y_2^*) and Efforts (y_3^*)

First, in Model (4) effort is found to be a significant variable to explain both advantages. In fact, as coefficients are standardized, we can say that it is one of the most important driver of these advantages. Because of this fact alone, all the other variants of our framework are weaker in the sense that they treat as a residual what is found to be a particularly crucial determinant of people’s wellbeing.

Further, Model (4) detects a significant relationship between the two considered dimensions of wellbeing. Advantage for material conditions is found to be a significant driver of advantage for life satisfaction. This result provides support for the adequacy of treating wellbeing as a multidimensional concept, which is a strength shared only by Models (3) and (4). However, as the latter omits to take explicit account of effort, Model (4) still overpowers Model (3).

Next, we find robust evidence for inequality of opportunity for wellbeing, as the circumstances 'being indigenous' and 'schooling of household head at age 14' consistently show respective negative and positive effects on the different measures/dimensions of wellbeing, across all the considered variants. However, both these circumstance variables are also significant determinants of effort in Model (4). Since effort is a significant determinant of both our dimensions of wellbeing, this also means that there is an *indirect channel* through which inequality of opportunity for wellbeing is at play, which the other models fail to capture, thus underestimating the total influence of circumstances. Model (4) is the only variant that allows to disentangle *direct and indirect* inequality of opportunity for wellbeing by virtue of the proposed exclusion restrictions.

As a robustness check, we also estimated an alternative specification of Model (4) with no exclusion restrictions, which only gives the reduced form (total) effects. We find that the *total* association coefficients are similar in magnitude (see Appendix A), which goes on to provide some empirical support for the validity of our exclusion restrictions.

Finally, from a technical viewpoint, the full model has a slightly higher explanatory power compared to all the other variants.

In view of the above, the remainder of this section goes further with the analysis of the results yielded by Model (4) *with* exclusion restrictions, digging deeper into the message that they are able to bring out, if one feels that our exclusions are reasonably well justified in theory.

4.2.1 The Role of Social Expenditure in Correcting Inequality of Opportunity for Wellbeing

Let us examine more closely two important manifestations of inequality of opportunity highlighted by our results and how our policy variables act on them. The two factors are ethnic disparities acting against indigenous people and imperfect intergenerational social mobility i.e. a tendency for perpetuation of wellbeing levels over generations (cf. Table (4) below).

We find that municipal public expenditures on social services contribute quite differently to redress the two unfair situations mentioned above. In the case of material conditions advantage, these expenditures significantly reduce unfair disparities caused by being indigenous, but they do not have a significant effect in reducing disparities caused by having an unprivileged family background. On the other hand, if we consider life satisfaction advantage, we find that these expenditures have contributed to reduce the negative effects of having an unprivileged background, without acting on the effect of being indigenous.

4.2.2 Effect of the Circumstance 'Being Indigenous'

Being indigenous proxied by having an indigenous language as mother tongue is found to be a particularly hindering circumstance for both dimensions of wellbeing. Being indigenous reduces the average advantage scores of material conditions and life satisfaction by 0.41 and 0.34 standard deviations, respectively. Thus inequality of opportunity

for material conditions advantage greater than that for life satisfaction advantage. This is consistent with evidence documented elsewhere (e.g. Escobar 2010; Ocampo and Foronda 2007) concerning indigenous people's lacking equal opportunities in many material and non-material aspects of life, but mainly in terms of adequate living conditions.

Figure 3 shows how indigenous people are at a clear disadvantage in terms of the two considered dimensions of wellbeing; the median advantaged indigenous individual has scores of -0.475 and -2.555 for material conditions and life satisfaction, respectively, which are 1.567 and 2.587 standard deviations lower compared to the median advantaged non-indigenous individual. Adopting the interquartile range rule for detecting outliers, scores that can be considered as outliers for indigenous people are well within the normal range for the non-indigenous group. Similarly, the lowest outlying values for non-indigenous individuals fall within the normal range for indigenous individuals.

Our framework allows us go further and identify that 85% and 66% of inequality of opportunity for material conditions advantage and life satisfaction advantage respectively, that can be attributed to being indigenous, is *direct*. Thus the remaining 15% and 34% of the negative effect of being indigenous on the corresponding dimensions of wellbeing can be attributed to the negative effect of this circumstance on the capacity of indigenous people to exercise efforts for improving their wellbeing. This is quite a novel result in our view showing that ethnic disparities are a complex structural problem in Bolivia in the sense that they build up from early stages of life to evolve into an unjust state of affairs that cannot be completely understood by merely assessing the current situation. Although educational disparities against indigenous people is a well-documented issue in Bolivia [see e.g. UNDP (2010) for a good review], this literature does not necessarily connect it to the subsequent effects of these disparities on people's wellbeing. This may be mainly due to data limitations, but our framework manages to provide a novel quantitative evaluation of this connection, as we take education to be a partial manifestation of effort.

As mentioned earlier, the unfair situation that we describe above has been partly mitigated by the social expenditure at the municipal level. Now, using Eq. (15), we can estimate the *optimal* configuration of average per capita municipal expenditures on social services to be around 109.- USD (in 2000 PPP). At this level, the effect of being indigenous on material conditions advantage is fully nullified.

In Fig. 4 we plot the distribution of distances to the optimal expenditure for all municipalities. We see that practically all the Bolivian municipalities (152 out of 159) register a considerable gap between the actual expenditure on social services and the *optimal* expenditure for eliminating ethnic disadvantage. The median increase in expenditure needed would be around 67.5 USD per capita, representing an average increase of around 2.6 times the current level of expenditure.

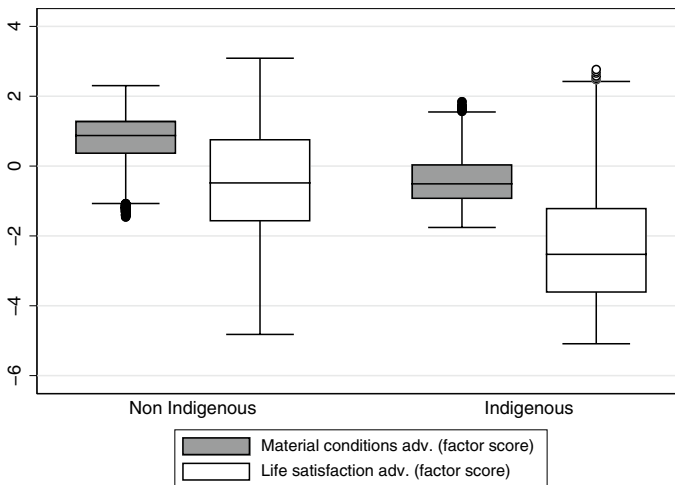
4.2.3 Effect of the Circumstance 'Family Background'

Having a privileged family background as measured by completed years of school of the household head (which is normally one of the parents) when respondents were 14 years old is a favorable circumstance for higher comforts and better wellbeing perception. One additional year of schooling of the household head tends to increase the advantage

Table 4 Decomposing the effects of circumstances on dimensions of wellbeing

	Effects on material conditions advantage				
	Total	Direct	Indirect	% Dir.	% Indir.
Indigenous (C_1)	- 0.4069***	- 0.3472***	- 0.0597**	85%	15%
School head at 14 (C_2)	0.0759*	- 0.0206	0.0965***	0%	100%
Soc. expend. $\times C_1$	0.1614***	0.1621***	- 0.0006	100%	0%
Soc. expend. $\times C_2$	0.0645	0.0580	0.0065	NS	NS
	Effects on life satisfaction advantage				
	Total	Direct	Indirect	% Dir.	% Indir.
Indigenous (C_1)	- 0.3444***	- 0.2271***	- 0.1174**	66%	34%
School head at 14 (C_2)	0.1816***	0.1283**	0.0533***	71%	29%
Soc. expend. $\times C_1$	0.0632	0.0247	0.0385	NS	NS
Soc. expend. $\times C_2$	- 0.1277***	- 0.1493***	0.0215	100%	0%

*** $p < 0.001$; ** $p < 0.05$; * $p < 0.1$

**Fig. 3** Effect of being indigenous on the dimensions of wellbeing

in the first dimension by 0.014 standard deviations and the second advantage by 0.074 standard deviations.

As can be seen from Fig. 5, half of the people whose parents are completely uneducated have an advantage score of material conditions ranging between 0.349 and - 0.853, whereas, at the other extreme, half of the people with parents having 17 years of schooling (completed tertiary education) have an advantage score ranging between 1.830 and 1.310. Not only is the second group at a higher level, but it also is less disperse. It is interesting to note that as family background improves, the normal range of advantage scores for the less privileged group tends to be atypical for the more privileged group.

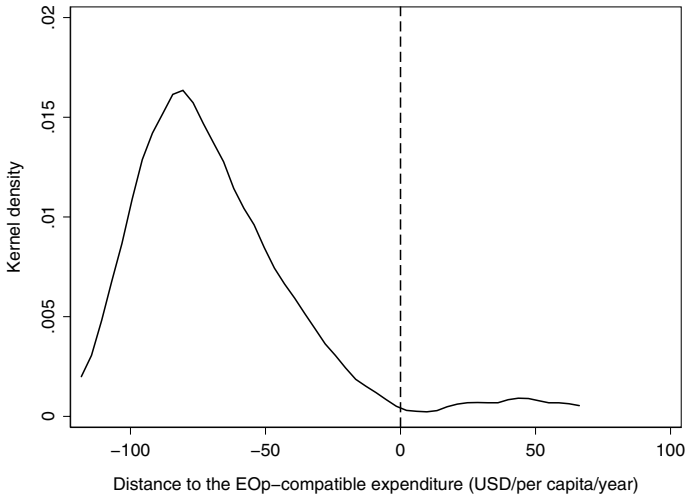


Fig. 4 Distance to perfect EOp expenditure on social services with respect to ethnicity

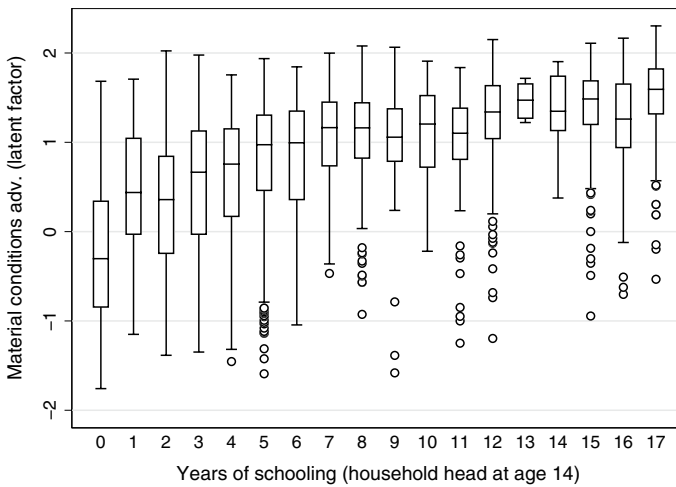


Fig. 5 Effect of family background on material conditions advantage

Similar qualitative effects of family background are found for the other considered dimension of wellbeing, namely life satisfaction advantage. However, there is more dispersion in advantage scores of this dimension compared to the previous one, even at more favorable levels of family background (see Fig. 6). We also encounter the same asymmetry in equality of opportunity, since advantage scores of less privileged groups tend to become atypical as family background improves.

Digging deeper into these results, we find that all the effect of family background on material conditions advantage is *indirect* and it goes through efforts (see Table 4). We find no evidence of a direct effect of family background on this dimension of wellbeing. Thus,

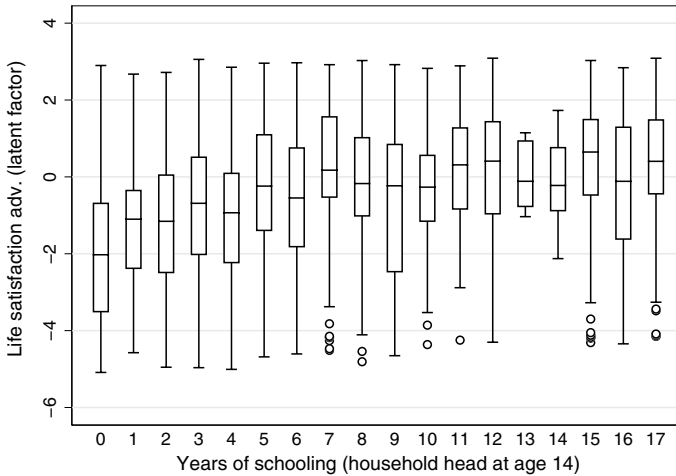


Fig. 6 Effect of family background on life satisfaction advantage

in our context, limiting oneself to only studying the direct effect of family background on material wellbeing will amount to the omission of a crucial mediator, which is people's actions towards acquiring advantages. Turning to life satisfaction advantage, we find that 71% of the effect of family background is direct. This means that having had a privileged family circumstance plays a great role in shaping people's perceptions in life.

Although our results prove that intergenerational social immobility is strong in the country, municipalities have indeed managed to reduce one aspect of this unfair state of affairs through social service expenditures. We find that more and better provision of social services have contributed to mitigate the negative effect of having unprivileged family backgrounds on life satisfaction advantage. These people seem to have benefitted more from this public expenditure compared to people enjoying more privileged family backgrounds. We are not able to detect a similar effect for material conditions advantage; we believe this is due to the fact that all the family background effect goes through efforts and thus, a larger timespan than the one we consider here may be required.

Although expenditure on social services has contributed to redress inequality of opportunity for life satisfaction advantage caused by unprivileged family background, it is still far from being optimal. The optimal mean level of expenditure for achieving this perfect EOp situation is 87.- USD (2000 PPP) per capita, which is derived from equation (15). As shown in Fig. 7, the actual municipal expenditures are considerably away from the EOp optimal value for many Bolivian municipalities (148 out of 159). The median underperforming municipality would have to spend around 51.- USD more per capita per year, representing an increase of more than 1.6 times the current level of expenditure.

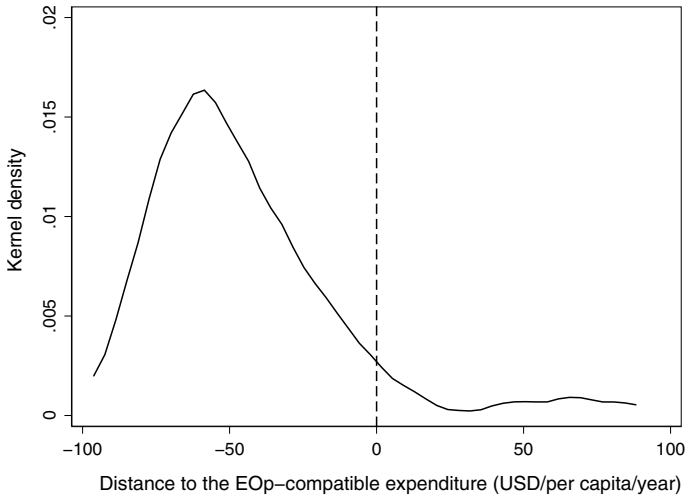


Fig. 7 Distance to perfect EOp expenditure on social services with respect to family background

5 Concluding Remarks

A growing theoretical and empirical body of academic literature on the connection between public policy and individual disparities based on John Roemer's Equality of Opportunity approach is becoming increasingly influential in policy circles. This study extends this approach to a broader setting by taking a multidimensional view of individual wellbeing and explicitly modelling the various channels through which public policies may be associated with wellbeing improvements.

After developing a theoretical structure for identifying the various links between wellbeing, efforts, circumstances and public policies, we practically implement it in the Bolivian context and highlight the added value of our framework for studying policy connections with inequality of opportunity for wellbeing and making policy recommendations. In particular:

- (i) We show how an explicit account of effort and its indicators in our model sheds new and useful light on the way public policies relate to wellbeing. In fact, in the Bolivian case, effort is found to be one of the most important drivers of wellbeing and thus it is a crucial mediating factor.
- (ii) We show that choosing a single observable indicator of wellbeing implies taking a narrow view of people's lives, and can be problematic for policy recommendations as results vary considerably from one indicator to the other. On the other hand, enlarging the concept of wellbeing to include multiple aspects of life, drawing inspiration from Sen's CA, provides a more complete picture for policy guidelines. In our Bolivian illustration, considering different dimensions of advantage and multiple indicators as manifestations of these advantages allows us to compare and contrast the effects between circumstances and wellbeing dimensions as well as understand how policy variables mediate this connection.

- (iii) We show that there is a strong interdependence among the different dimensions of wellbeing which is often ignored by traditional approaches. In the Bolivian case, we see that intangible (subjective) dimensions of people's wellbeing such as life satisfaction, are significantly associated with objective dimensions such as material conditions. This emphasizes the need for a simultaneous consideration of different dimensions of wellbeing when analysing connections with public policies as otherwise the feedback loops are missed out in the total assessment.
- (iv) We thus propose a general econometric framework that accounts for influences of circumstances on all dimensions of wellbeing as well as efforts, and of public policies on the strength of influence of circumstances. Thus we are able to identify direct influences of circumstances on wellbeing, as well as indirect effects that arise from the influence of circumstances over efforts. In fact, we show that in the Bolivian case, the effect of family background on material conditions advantage is *only indirect* and it goes through individual effort.

Our proposed framework also allows us to derive the optimal configuration of public policies that fosters an ideal state of equality of opportunity, meaning that which completely nullifies the influence of hindering circumstances over individual advantages and efforts. We find that practically all of the Bolivian municipalities are still quite far from a situation of *optimal* levels of public expenditure on social services according to this criterion. A word of caution is in order regarding this result, as the *optimal* levels obtained may seem practically infeasible given the potentially huge amount of additional public resources needed to reach these optimal levels, especially in developing countries. This is because policy effectiveness is held constant in our setting. Moreover, as pointed out in the beginning of Sect. 4, we only take into account the lagged values of our policy variables to let some time elapse between policy decision and wellbeing measurement. However in real-life policy action is a continuous process and if policy makers learn to become more and more effective, i.e. their effect on the effects coefficients of circumstances increases over time, then the EOp optimal state of affairs would become well within reach in a reasonable time span. In fact, we believe that this could be a more desirable path, especially if resources are limited, but it requires a deeper investigation of how policy influences change over time and an appropriate modelling of their dynamics, which go beyond the scope of the current study.

Open Access This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>.

Appendix A: Estimation Results Without Exclusion Restrictions

See Table 5.

Table 5 Standardized coefficients capturing total associations

	Model (4)		
	Dep. y_1^*	Dep. y_2^*	Dep. y_3^*
Indigenous (C_1)	- 0.3946***	- 0.3133***	- 0.1192**
School of head at 14 (C_2)	0.0558	0.1205**	0.2523***
Soc. expend. $\times C_1$	0.1571***	0.0532	- 0.0118
Soc. expend. $\times C_2$	0.0789	- 0.1007**	0.0381
Mat. Cond. Adv. (y_1^*)	- 0.0402	0.4669	
Life Satisf. Adv. (y_2^*)	- 0.0826	- 0.0402	
Effort (y_3^*)	0.3333***	0.1901***	
All controls	Yes	Yes	Yes
R^2	0.66	0.39	0.53

*** $p < 0.001$; ** $p < 0.05$; * $p < 0.1$

Model (4): Three latent dependent variables are considered:

Material conditions advantage (y_1^*),

Life satisfaction advantage (y_2^*) and Efforts (y_3^*)

Appendix B: Unstandardized Structural Coefficients

See Table 6.

Table 6 Estimation Results (unstandardized coefficients)

	Model			
	(1a)	(1b)	(2a)	(2b)
Indigenous (C_1)	- 0.9821***	- 1.4631***	- 0.8612***	- 1.8692***
School of head at 14 (C_2)	0.0067***	0.0113***	0.0175***	0.0798***
Soc. expend. $\times C_1$	0.0075**	0.0028**	0.0072***	0.0133***
Soc. expend. $\times C_2$	0.0000	0.0001	0.0001***	- 0.0001
Controls	Yes	Yes	Yes	Yes
R^2	0.45	0.15	0.62	0.25

	Model				
	(3)		(4)		
	Dep. y_1^*	Dep. y_2^*	Dep. y_1^*	Dep. y_2^*	Dep. y_3^*
Indigenous (C_1)	- 0.9050***	- 0.5742***	- 0.7628***	- 1.1346***	- 0.0489**
School of head at 14 (C_2)	0.0139***	0.0324***	- 0.0037	0.0521**	0.0085***
Soc. expend. $\times C_1$	0.0088***	0.0028	0.0070***	0.0024	- 0.0001
Soc. expend. $\times C_2$	0.0002***	- 0.0003**	0.0001	- 0.0006***	0.0000
Mat. Cond. Adv. (y_1^*)		0.9218***		0.5659*	
Life Satisf. Adv. (y_2^*)	0.0220		0.0248		
Effort (y_3^*)			1.8088***	1.6414*	
Controls	Yes	Yes	Yes	Yes	Yes
R^2	0.64	0.35	0.70	0.39	0.54

*** $p < 0.001$; ** $p < 0.05$; * $p < 0.1$

The dependent variables are as follows:

Model (1a): Basic living conditions index (observed)

Model (1b): Satisfaction with the most important aspect to live well (observed)

Model (2a): Material conditions advantage (latent, noted y_1^*)

Model (2b): Life satisfaction advantage (latent, noted y_2^*)

Model (3): Two latent dependent variables are considered:

Material conditions advantage (y_1^*) and Life satisfaction advantage (y_2^*)

Model (4): Three latent dependent variables are considered:

Material conditions advantage (y_1^*), Life satisfaction advantage (y_2^*) and Efforts (y_3^*)

References

- Alkire, S., & Foster, J. (2011). Counting and multidimensional poverty measurement. *Journal of Public Economics*, 95(7–8), 476–487.
- Anand, P., Krishnakumar, J., & Ngoc, B. (2010). Measuring welfare: Latent variable models for happiness and capabilities in the presence of unobservable heterogeneity. *Journal of Public Economics*, 95(3–4), 205–215.
- Arneson, R. (1989). Equality and equal opportunity for welfare. *Philosophical Studies*, 56, 77–93.
- Asadullah, M., & Yalowitzky, G. (2012). Inequality of educational opportunity in India: Changes over time and across states. *World Development*, 40(6), 1151–1163.
- Atkinson, A. B. (2019). *Measuring Poverty Around the World*. Princeton: Princeton University Press.
- Atkinson, A. (2003). Multidimensional deprivation: Contrasting social welfare and counting approaches. *Journal of Economic Inequality*, 1, 51–65.
- Betts, J., & Roemer, J. (2005). *Equalizing opportunity for racial and socioeconomic groups in the United States through educational finance reform*. Economics Working Paper Series, University of California at San Diego, Department of Economics.
- Bourguignon, F., Ferreira, F., & Menéndez, M. (2007). Inequality of opportunity in Brazil. *Review of Income and Wealth*, 53(4), 585–618.
- Coco, G., & Pignataro, G. (2010). *Wealth inequality, unequal opportunities and inefficient credit market*. Quaderni DSE Working Paper N. 851, University of Bologna.
- Cogneau, D., & Gignoux, J. (2008). Earnings inequality and education mobility in Brazil over two decades. In S. Klasen & F. Nowak-Lehmann (Eds.), *Poverty, Inequality and Policy in Latin America*. USA: MIT Press.
- Di Tommaso, M. L. (2007). Children's capabilities: A structural equation model for India. *The Journal of Socio-Economics*, 36, 436–450.
- Escobar, A. (2010). Latin America at a crossroads: Alternative modernizations, post-liberalism, or post-development? *Cultural Studies*, 24(1), 1–65.
- Ferreira, F., Gignoux, J., & Aran, M. (2011). Measuring inequality of opportunity with imperfect data: The case of Turkey. *Journal of Economic Inequality*, 9(4), 651–680.
- Ferreira, F., & Gignoux, J. (2013). The measurement of educational inequality: Achievement and opportunity. *The World Bank Economic Review*, 28(2), 210–246.
- Ferreira, F., & Gignoux, J. (2008). The measurement of inequality of opportunity: Theory and application to Latin America. *Journal of Income and Wealth*, 57(4), 622–657.
- Figueiredo, E., & Ziegelmann, F. (2010). Estimation of opportunity inequality in Brazil using nonparametric local logistic regression. *Journal of Development Studies*, 46(9), 1593–1606.
- Forgeard, M. J., Jayawickreme, E., Kern, M. L., & Seligman, M. E. (2011). Doing the right thing: Measuring wellbeing for public policy. *International Journal of Wellbeing*, 1(1), 79–106.
- Gaspar, D. (2007). What is the capability approach?: Its core, rationale, partners and dangers. *The Journal of Socio-Economics*, 36(3), 335–359.
- Haq, M. (1999). *Reflections on human development*. Delhi: Oxford University Press.
- Hederes, K., Jantti, M., & Lindahl, L. (2017). Gender and inequality of opportunity in Sweden. *Social Choice and Welfare*, 49, 605–635.
- Hidalgo-Hidalgo, M., & Iturbe-Ormaetxe, I. (2018). Long-run effects of public expenditure on poverty. *The Journal of Economic Inequality*, 16(1), 1–22.
- Horn, P. (2017). From recognition to implementation of ethno-racial justice: Contradictory urban indigenous politics in Bolivia. *International Journal of Urban and Regional Research*. The Open University.
- Islam, T. T., & Mitra, S. (2017). Multidimensional human opportunity index. *Social Indicators Research*, 130(2), 523–535.
- Jacquet, L., & van de Gaer, D. (2011). A comparison of optimal tax policies when compensation or responsibility matter. *Journal of Public Economics*, 95(11), 1248–1262.
- Jusot, F., Tubeuf, S., & Trannoy, A. (2013). Circumstances and efforts: How important is their correlation for the measurement of inequality of opportunity in health? *Health Economics*, 22(12), 1470–1495.
- Krishnakumar, J. (2007). Going beyond functionings to capabilities: An econometric model to explain and estimate capabilities. *Journal of Human Development*, 8(1), 29–63.
- Krishnakumar, J., & Nogales, R. (2015). Public policies for wellbeing with justice: A theoretical discussion based on capabilities and opportunities. *International Journal of Wellbeing*, 5(3), 44–62.
- Krishnakumar, J., & Nogales, R. (2018). Demystifying the use of simultaneous equation models for operationalising the capability approach. In F. Comim, S. Fennell, & P. Anand (Eds.), *New frontiers of the capability approach* (pp. 246–270). Cambridge: Cambridge University Press.

- Krishnakumar, J., & Wendelspeiss, F. (2011). *The impact of oportunidades on inequality of opportunity in rural and urban areas in Mexico*. Working Paper, University of Geneva, Switzerland.
- Layard, R. (2006). Happiness and public policy: A challenge to the profession. *The Economic Journal*, 116(510), C24–C33.
- Mahler, D., & Ramos, X. (2017). Equality of opportunity for well-being. *Presented at the IARIW-Bank of Korea conference*, July 2017
- Muthén, B. (1983). Latent variable structural equation modeling with categorical data. *Journal of Econometrics*, 22(1–2), 43–65.
- Muthén, B. (1984). A general structural equation model with dichotomous, ordered categorical and continuous latent variable indicators. *Psychometrika*, 49(1), 115–132.
- Muthén, B. (2002). Beyond SEM: General latent variable modeling. *Behaviormetrika*, 29(1), 1–117.
- Muthén, B. (1998–2004). *Mplus Technical Appendices*. Los Angeles, CA: Muthén & Muthén.
- Neidhofer, G., Serrano, J., & Gasparini, L. (2018). Educational inequality and intergenerational mobility in Latin America: A new database. *Journal of Development Economics*, 134, 329–349.
- Ocampo, M., & Foronda, C. (2007). Estudio de la calidad de vida en Bolivia: metodología y medición. *Investigación y Desarrollo*, 7, 25–40.
- Pignataro, G. (2012). Equality of opportunity: Policy and measurement paradigms. *Journal of Economic Surveys*, 26(5), 800–834.
- Ramos, X., & van de Gaer, D. (2012). *Empirical approaches to inequality of opportunity: Principles, measures, and evidence*. IZA Discussion Papers 6672, Institute for the Study of Labor (IZA).
- Roemer, J. (1998). *Equality of opportunity*. Cambridge: Harvard University Press.
- Roemer, J., Rolf, A., Ugo, C., Johan, F., Stephen, P., Arnaud, L., et al. (2003). To what extent do fiscal regimes equalize opportunities for income acquisition among citizens? *Journal of Public Policy*, 87(3), 539–565.
- Schokkaert, E. (2007). *The capabilities approach*. Discussion Paper Series, 07-34, Center for Economic Studies, Katholieke Universiteit Leuven.
- Sen, A. (1980). Equality of what? In S. McMurrin (Ed.), *The Tanner lecture on human values* (Vol. I, pp. 197–220). Cambridge: Cambridge University Press.
- Sen, A. (1985). *Commodities and capabilities*. Amsterdam: North Holland.
- Sen, A. (1999). *Development as freedom*. Oxford: Oxford University Press.
- Sen, A. (2009). *The idea of justice*. Cambridge, MA: Harvard University Press.
- Skrondal, A., & Rabe-Hesketh, S. (2004). *Generalized latent variable modeling: Multilevel, longitudinal and structural equation models*. Boca Raton, FL: Chapman & Hall/CRC.
- UNDP, Bolivia (2010). *Los cambios detrás del cambio: desigualdades y movilidad social en Bolivia*. Country HDR.
- Van de Gaer, D., Vandenbossche, J., & Figueroa, J. (2013). *Children's health opportunities and project evaluation: Mexico's Oportunidades program*. Policy Research Working Paper Series 6345, World Bank.
- Wendelspeiss, F. (2015). Measuring inequality of opportunities with latent variables. *Journal of Human Development and Capabilities*, 16(1), 106–121.
- Yalonetzky, G. (2012). A dissimilarity index of multidimensional inequality of opportunity. *Journal of Economic Inequality*, 10(3), 343–373.